

REMARKS

The Invention

Applicants claim an axial flow catalyst pack for the catalytic decomposition of monopropellant fuels. The invention includes an array of stacked metal plates having precisely aligned flow passages, which enhance lateral flow across each plate. Each of the plates of the device has a surface of catalytic material. Moreover, each of the plates of the assembly has a portion removed from the downstream side of the plate to promote lateral flow of the liquid between the plates.

Status of the Claims

Claims 1-15 and 17-21 were examined and stand rejected by the Examiner under 35 U.S.C. §103(a) over various references. Claim 9 is amended to depend from claim 8.

Rejections under 35 U.S.C. § 103(a)

Over Hsu et al. ("Hsu") in view of Ashmead et al. ("Ashmead")

Claims 1-4, 6-11, 13-15, 17-19 and 21 are rejected as allegedly being obvious over the combination of Hsu and Ashmead. The Applicants respectfully disagree with the Examiner's position regarding these claims.

In the response to the first office action, the Applicants argued, *inter alia*, that the claims were not obvious over Hsu in view of Ashmead, because the combination of references failed to disclose or suggest each element of the claimed invention. The Applicants explained that the references neither disclose or suggest a device comprising a plurality of stacked, contiguous thin metal plates in which ***every plate has a surface of catalytic material***. The recited element is found in each of the independent claims.

The present office action states that the element of a plurality of catalytic plates arranged in a stacked, contiguous manner is not found in Applicant's claims.

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Applicant respectfully submits that the pending claims were misinterpreted. Claim 1 explicitly states that the device comprises:

...a plurality of thin metal plates in a stacked contiguous relation, **each such plate having a surface of catalytic material...**

Each thin metal plate has a surface of catalytic material. A plate having "a surface of catalytic material" is a catalytic plate. Thus, the device of claim 1 includes a plurality of "catalytic plates" stacked in a contiguous manner. As claims 2-7 are directly or indirectly dependent upon claim 1, they include this element as well.

Moreover, claim 8 recites that the device includes:

...a plurality of thin metal plates in a stacked contiguous relation, **each such plate having a surface formed of catalytic material...**

Since claims 9-14 are directly or indirectly dependent upon claim 8, they are interpreted as including the element(s) recited in claim 8.

Claim 15 sets forth a device that includes a catalyst bed:

...the **catalyst material** being **configured as the surface material** of a plurality of stacked, contiguous thin metal plates...

As claims 16-19 and 21 are each directly or indirectly dependent upon claim 15, these claims include the recited element.

Thus, all of the original claims in the present application recite a device in which each of the contiguous metal plates has a surface of catalytic material.

Accordingly, Applicants respectfully request that the Examiner review the arguments set forth in the first response as well as those provided herein in view of the fact that the claims include the element upon which Applicants' arguments are based.

If the Examiner feels that the language of the claims fails to clearly specify that the plurality of plates is a plurality of catalytic plates, the Applicants would be pleased to consider any appropriate claim amendments suggested by the Examiner.

Hsu Discloses Catalytic Plates Separated by Conductive Plates

The present action states that Figures 2A, 2B and 2C of Hsu disclose a device that includes a plurality of contiguously stacked metal plates, each having a surface of catalytic material. The Applicants respectfully disagrees with the characterization of the disclosure of Hsu.

As pointed out in the earlier response, Hsu discloses a device in which “a number of thermally conductive plates 12 and reforming plates 14 are *alternately* stacked together to form a stacked reforming structure...” See, column 4, lines 21-24. The reforming plates include a catalyst (column 4, lines 64-64), which is *not present* on the conductive plates. Thus, the Hsu device is a stack of alternating catalytic reformer plates and *non-catalytic* conducting plates. Therefore, Hsu neither discloses nor suggests Applicants’ device in which a plurality of catalytic plates are arranged in a contiguous manner.

The office action states that Hsu discloses a device in which each plate “is in contact with catalyst”. The Applicants, however, do not claim a device in which each plate “is in contact with a catalyst,” rather the claims set forth a device in which each plate has “a surface of catalytic material.” Applicants submit that the two configurations are not equivalent and none of the references suggest that they are equivalent. Therefore, Hsu cannot be interpreted as suggesting a device that utilizes only catalytic plates, such as that claimed by the Applicants.

Hsu Provides a Device Utilizing Two Distinct Plate Types

In contrast to Applicants’ invention, in which a plurality of catalytic plates are contiguously positioned, the Hsu device includes alternating catalytic (reforming) plates and conductive plates; Hsu does not disclose a device with two or more contiguous reforming plates or two or more contiguous conductive plates. Therefore Hsu teaches a

device that includes a stack with two distinct types of plates. Two plates of the same type are never stacked contiguously; a plate of the second type is always interposed between two plates having the same function.

Furthermore, the reforming plates and the catalytic plates cannot be considered equivalent; they have distinct functions within the device. For example, Hsu states:

The reforming plate 14 can be composed of any suitable reforming catalytic material... The reforming plate 14 can further include a ceramic support plate that has a reforming material coated thereon, as illustrated in FIGS. 2A and 2B. Column 6, lines 21-29.

In describing conductive plates Hsu states:

The conductive plate 12 can be formed of any suitable thermally conductive material ... The thickness of the conductive plate 12 can be selected to maintain a minimum temperature gradient in-plane of the plate 12 and to thereby provide an isothermal region for optimum reforming reaction and to alleviate thermal stress in the reforming plates 14." Column 6, lines 35-44.

Thus, Hsu explicitly sets forth a *reforming plate* and a *conductive plate* as separate elements performing different functions within the disclosed device, and composed of materials selected as suitable in performing their respective functions. Hsu does not describe a *reforming catalytic material* and a *thermally conductive material* as being equivalent, and the office action fails to provide any disclosure identifying these materials as equivalent.

Moreover, Hsu discloses that the reforming plates are not sufficiently thermally conductive to be used alone. Hence the disclosed device requires a separate

and distinct conductive plate to maintain a thermal environment in which the device can function. The disclosure further teaches that a plate formed from a *reforming catalytic material* and a plate formed from a *thermally conductive material* are not equivalent.

Furthermore, Hsu teaches that the conductive plates cannot be removed from the device without changing its principle of operation. To modify Hsu to produce Applicants' claimed invention, the conductive plates must be removed from Hsu, thereby changing its principle of operation. The law is settled that a proposed modification or combination that changes the principle of operation of the disclosure being modified is not permitted and is not sufficient to render the claims *prima facie* obvious. In re Ratti, 270 F.2d 810 (CCPA 1959).

The Two Types of Plates of Hsu Include a Single Flow Through Hole

Applicants' device further differs from that of Hsu. As claimed, Applicants' device utilizes a plurality of plates, *each plate including a plurality of flow through holes* to allow the reactant to flow through the plates. See, e.g., claim 1. In contrast, the plates in the device of Hsu include a single central opening that runs axially through the length of the device.

Referencing Figure 2, Hsu states:

The reactant mixture 22 is introduced to the manifold 16 by any appropriate means, such as by fluid conduits. The mixture enters the inner portions of the reformer through reactant passages 24 that are formed between the adjacent conductive plates 12 and reforming plates 14...which constitutes a substantially continuous fluid passage that extends from the manifold 16 to the outer peripheral surface 13A of the stacked reforming structure. See, column 4, lines 47-56.

used interchangeably
Thus, fluid flow in Hsu's device includes flow through a *single central manifold* 16. The fluid is distributed from the single manifold to voids between adjacent plates and out to the "outer peripheral surface of the device." The language "outer peripheral surface"

suggests that the reactant mixture leaves the device, exiting through the outer peripheral surface.

In contrast, Applicants' claims set forth a device that includes a "plurality of flow through holes". The plurality of flow through holes allows flow of the fuel axially through the stacked plates. As Hsu does neither disclose nor suggest a device with multiple flow through holes in the two types of plates, this element is missing from Hsu and the reference cannot form a proper basis for a *prima facie* case of obviousness.

Claims 2, 9 and 17

With respect to claims 2, 9 and 17, the action states that the claims fail to recite that the metering plates are located between groups of plates having the same function. Applicants respectfully submit that the element is found in claims 2, 3, 9, 10, 17 and 18. The referenced claims recite that the:

plurality of plates comprises a
plurality of groups of said plates,
each said group being separated
from adjacent said groups by a
metering plate...

As discussed above, *each* of the plurality of plates set forth in the independent claims includes a surface of a catalytic material. Thus, *each plate of the recited plurality of plates is a catalytic plate*. Therefore, claims 2, 3, 9, 10, 17 and 18 set forth a flow adjustment element that is interleaved between groups of catalytic plates, i.e., plates having the same function.

The action also states that Hsu discloses a flow adjustment element, which is alleged to include Applicants' claimed metering plate. Hsu states:

As shown in FIG. 4, a reactant flow adjustment element 80 can be interposed between the electrolyte plate 50 and the interconnector plate 60. See, column 10, lines 13-15.

Thus, Hsu discloses a flow adjustment element that is interposed between plates having different functions.

In contrast to the flow adjustment element of Hsu, Applicants' metering plate is interposed between groups of catalytic plates, i.e., plates having the identical function. As the invention must be examined as a whole, the position of the metering plate with respect to the other components of the device must receive due consideration. As Hsu does not disclose or suggest a device constructed from a plurality of contiguous catalytic plates, Applicants' metering plate, located between groups of contiguous catalytic plates is not suggested by Hsu. Hsu's suggestion that the flow adjustment element can be of any design does not alter this essential fact.

Claim 3, 10, 18 and 21

Regarding claims 3, 10, 18 and 21, the action asserts that, because Hsu discloses that a flow adjustment element can be of any design, Applicants' device in which the holes in the metering plates downstream are larger than those of metering plates upstream is obvious.

Contrary to Hsu, Applicants claim a device that includes a metering plate positioned between *groups of a single type of plate, performing the same function*. Hsu neither discloses nor suggests the desirability of placing a flow control element between two identical plates. In fact the only disclosure presently of record that suggests interposing a flow control element between two identical plates is the Applicants' specification. Accordingly, in the absence of some suggestion other than that found in Applicants' specification, it is submitted that the present rejection is based upon improper hindsight and the claims 2, 9 and 17 are patentably non-obvious over the art of record.

Specifically regarding claim 21, no reference presently of record discloses or suggests a device composed entirely of a plurality of catalytic plates in which the open area ratio of the plates increase in the direction of flow. The only teaching of this element is found in Applicants' specification.



Claims 4, 11 and 19

The office action states that Hsu discloses lateral flow through and between the plates, but fails to disclose a device in which the flow through holes are offset from plate to plate. The Examiner relies on Ashmead for the necessary disclosure.

In their previous response, the Applicants requested that the Examiner explicitly clarify the disclosure of Ashmead relied upon, because Applicants were unable to locate where in the cited section is found a disclosure of a plurality of *catalytic* plates with axially offset flow-through holes. The requested clarification has not been proffered in the present action. Thus, Applicants repeat their request for clarification.

Ashmead, at column 9, lines 47-65 discusses structures that are patterned onto the opposing faces of two contiguous plates, providing *lateral* flow of the fluid, not *axial flow through* combined with lateral flow. The Examiner refers to FIG. 4 and 5, however, Applicants cannot determine what portion of the cited figures the Examiner finds relevant. The cited figures, in fact demonstrate that the Ashmead device uses axially aligned flow-through holes. *See*, for example, FIG. 4, 130V, 230V, 330V, 430V, and 530V; and FIG. 5, 120V, 220V, 50V, 550V, 650V, 750V, and 850V. Applicants are unable to locate the section of Ashmead alleged to disclose the combination of axial and lateral flow.

Applicants submit that combining Ashmead with Hsu fails to set forth a *prima facie* case of obviousness; the combination fails to disclose a device composed of a plurality of stacked, contiguous plates having the same function, i.e. catalysis. Ashmead does not appear to disclose a device that includes a plurality of stacked, contiguous catalytic plates. Thus, whether or not Ashmead teaches axially offset holes is moot.

Claims 6 and 13

With respect to claims 6 and 13, the Examiner states that both Hsu and Ashmead disclose circular plates. Applicants are substantially in agreement with the Examiner's interpretation of the references. Applicants assert, however, that the absence

of explicitly recited elements from claims 1 and 8 upon which claims 6 and 13 depend, respectively, precludes a finding of obviousness of the subject claims.

Claims 7 and 14

Regarding claims 7 and 14, the Examiner concludes that both Hsu and Ashmead disclose that the plates are bonded in a monolithic stack. Applicants disagree that Hsu teaches a "monolithic" stack. Applicants use the term "monolithic" to refer to a bonded stack, distinguished from an unbonded stack ("...can operate as a monolithic stack or as an unbonded stack." page 10, line 18).

As discussed above, the combination of references fails to disclose or suggest elements of independent claims 1 and 8, from which claims 7 and 14 depend. Thus, Applicants submit that whether the stack of Hsu is properly defined as "fastened", "monolithic" or "bonded" is moot. Therefore, Applicants respectfully assert that the rejected claims are not obvious over the cited references.

Over Hsu in view of Ashmead in view of Koga

Claims 5, 12 and 20

Claims 5, 12, and 20 are rejected under 35 U.S.C. § 103(a) as being allegedly obvious over Hsu in view of Ashmead as applied to claims 1, 8 and 15, and further in view of Koga. The Examiner states that Koga teaches support columns on the plates.

Applicants earlier argued that Koga does not teach "support columns" as that term is used in the present claims. Applicants submit that whether or not Koga teaches support columns as claimed by the Applicants is moot. As discussed above, the references fail to disclose or suggest explicitly recited elements of independent claims 1, 8 and 15 from which claims 5, 12 and 20 depend. Therefore, Applicants respectfully assert that the rejected claims are not obvious over the cited references.

As the combination of references fails to disclose or suggest every element of Applicants' claimed invention, a proper *prima facie* case of obviousness cannot be set

forth over the combination of the cited references. Therefore, Applicants respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a) of claims 1-15, and 17-21 as being obvious over Hsu in view of Ashmead.

The References Do Not Motivate Their Combination

With regard to each of the rejections discussed above, Applicants further submit that the mere fact references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Some objective reason must exist for combining the references Ex parte Levengood, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993), and the proposed combination of references can not change the principle of operation of the prior art invention being modified In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). Applicants assert that neither Hsu nor Ashmead suggest their combination. Similarly, none of Hsu, Ashmead or Koga motivate their combination. Accordingly, the combinations are not permissible and cannot form the basis of a *prima facie* case of obviousness.

In the present rejection, the Office action makes no attempt to identify where in any of the three references one might find motivation for the proposed combination. Accordingly, Applicants respectfully submit that the Office Action as presented does not provide the motivation or objective reason to combine the teachings of the references necessary to form a *prima facie* case and therefore request that the rejection be withdrawn.

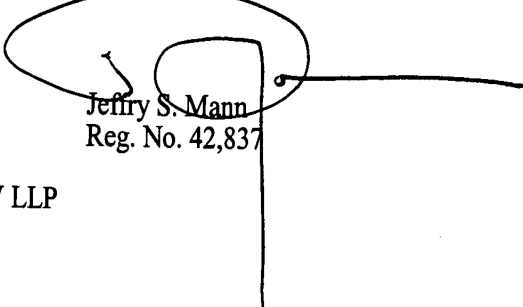
CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is urged. If the Examiner believes a telephone conference would aid in the prosecution of this case in any way, please call the undersigned at 415-576-0200.

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Application No.: 09/371,973
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PATENT

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